POCKET COMPUTER NEWSLETTER

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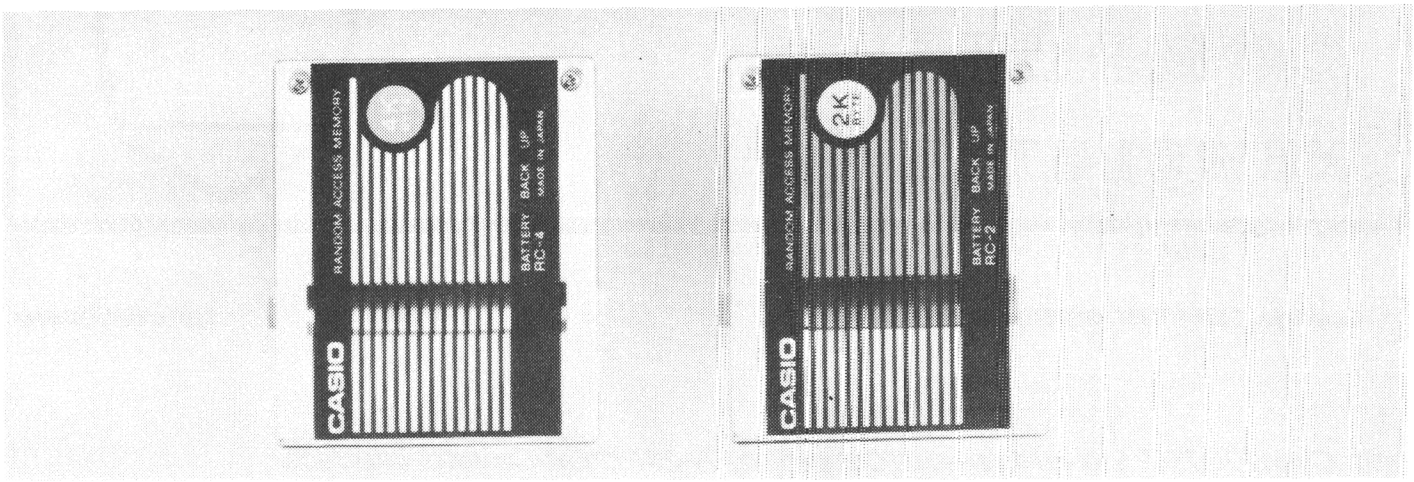
Photo *Casio FX-750P Shown Mounted on Companion FA-20 Printer/Cassette Interface.*

Another *Personal Information*™ product.

Photo *Casio RC-2 and RC-4 RAM Modules Can Expand Memory in the Casio FX-750P.*



CASIO INTRODUCES MODEL FX-750P

Casio has announced the availability of a compact hand-held scientific computer named the model FX-750P.

Designed primarily for engineers and those that work in the sciences, it includes scientific functions such as hyperbolics, stastical functions such as standard deviation, and powerful analytical capabilities, such as performing linear regression. The unit is also programmable in the BASIC language. It contains 4K of user RAM in its standard configuration. However, memory may be expanded to 6 or 8 kilobytes. This is accomplished by sliding in unique battery-backed "RAM cards" into the front of the unit. Two types of these cards are currently available. The model RC-2 contains 2 kilobytes of memory. The model RC-4 holds 4 kilobytes of memory. The battery-backed memory cards may be used to hold frequently utilized programs. These programs can then be quickly accessed by plugging in the appropriate module containing the desired program.

The FX-750P has a 24-character, single-line liquid-crystal alphanumeric display. The display also contains a number of status annunciators.

There are 58 keys on the unit. Almost all of these may be used in two or three modes through the use of the "F" (function) and "Shift" keys. When in the special modes these keys can invoke BASIC statements or mathematical functions.

The FX-750P can be connected to the Casio FA-20 printer/cassette interface. This permits the storing of programs on an audio cassette through the use of a separate tape recorder unit, or the printing of programs and/or data on a thermal printer that is part of the FA-20.

Casio states that over 30 software titles are available for the FX-750P. These include programs dealing with financial analysis, games, business, electronics, education, statistics, math and scientific/engineering disciplines.

The Casio FX-750P is said to have a U.S. list price of $129.95 and to be available from Casio sales outlets.

REVIEW OF THE SHARP PC-1261

Sharp Electronics has released a pair of new pocket computers dubbed the models PC-1260 and PC-1261. The models are equivalent except that the PC-1260 contains 4.5 kilobytes of user RAM while the PC-1261 contains 10.5 kilobytes of RAM. This review specifically covers the PC-1261.

The PC-1261 is identical in size to the earlier models PC-1250/1251. In fact, it may be used with the CE-125 printer/casette interface that was originally provided for those models. Despite its small size, the 1261 has a number of exciting additional features. For starters, its display is capable of showing two lines of 24 characters each. While the characters are slightly smaller in size than those of the earlier 1250, they are still highly readable. Of course, the 1261 includes the same kind of variable contrast control as that provided in its predecessor. Thus, the intensity of the display can be easily changed to compensate for actual lighting conditions. Most of the annunciators on the display of the 1261 are

indicated by the presence or absence of tiny cursor bars at the bottom of the screen. These correspond directly to legends that are provided on the case of the unit just below the LCD. The two-line display is an exciting advance for pocket computer users. It makes it much easier to input information as the query can be placed on one line while the answer appears on the second. Additionally, when outputting information, one line can serve for labels or identifiers while the second line reflects corresponding values.

The keyboard on the PC-1261 is identical in size and number of keys to the earlier PC-1250. However, Sharp, has made several significant improvements. For example, the right and left parentheses have been positioned over the digit 1 and digit 2 keys. They used to be over the scroll-up and scroll-down keys where they could cause a lot of trouble if you forgot to hit the shift key when you wanted to invoke a paren sign. Another change to the keyboard is the removal of the exponent character that was activated using the shifted + sign on the 1250. Now you just use the letter E. There are also two new functions that may be invoked from the keyboard that were not on the earlier 1250. These are the HELP function and SMALL function. The former is invoked by using shift-7. The latter by using shift-8. The SMALL function enables one to use upper and lower case characters. The HELP function brings up a compact reference that lists all of the possible key words available in the unit. This function can be expanded to provide examples of the use of each key word. The HELP function can even be used to bring up a character code table. This table lists the hexadecimal code for each displayable character.

The new PC-1261 is equipped with an impressive amount of ROM: 40 kilobytes! This amount of ROM enables the unit to contain an enhanced BASIC interpreter, the HELP function, and other features not found in previous models having such small physical size.

The PC-1261 has a powerful new feature that Sharp refers to as "Easy Simulation Programming." Perhaps a more appropriate description is "automated calculation." This feature allows you to put a number of formulas in memory, such as : A = B + C - D. The lefthand side of the equation must be preceded by a # sign and may only contain one variable. The righthand side of the equation may contain up to 9 variables. These formulas are saved in a special section of user RAM. The amount of memory set aside for this purpose may be specified by the user in 128-byte increments. Memory used for this purpose (over and above an initial 128-byte block) is taken away from BASIC program space.

In order to automatically calculate the value of an expression, you merely enter a # sign followed by the identifying variable (when the PC is in the RUN mode) and then the ENTER key. Doing this causes the variable names that are on the right side of the expression to appear on the top line of the display. The numerical value desired for each variable may then be entered on the second line of the display underneath the corresponding variable names. When the last value for an expression has been entered, the PC-1261 will automatically calculate the value for the expression and display it under the variable name assigned to the lefthand part of the equation. Once an initial set of values has been entered for an expression, you can quickly obtain a whole series of answers by varying parameter values at will. This is accomplished by moving the cursor to the variable values that you want to change and entering new data. Each time new data is entered, the expression is recalculated and displayed for the user.

The active engineer, scientist, mathematician, or businessman will like this automated formula-solving capability. A number of your favorite formulas can be stored in memory for instant recall and calculation. Since the PC-1261 allows variables to have multiple character names, you can even set up formulas using plain English statements such as NET = SALES - COST. If you do a lot of repetitive formula solving, you will definitely appreciate this somewhat novel feature.

The PC-1261 is a somewhat unique creature in that, along the lines of the 1250/1251, it tries to maintain programming compatability with the original PC-1211 while offering an expanded instruction set and advanced capabilities. Where it succeeds, of course, it means that PC-1211, PC-1250, PC-1250A, PC-1251, PC-1260 and PC-1261 programs are "upwards" compatible. (That "upwards" means that a program created on an earlier model should run on a later version. You may not, however, be able to go the other way.)

The best way to gain an overview of the 1261's operational and programming capabilities is to show a synopsis of its commands and keywords: ABS, ACS, AND, AREAD, ASC, ASN, ATN, BEEP, CHAIN, CHR$, CLEAR, CLOAD, CLOAD?, CLS, CONT, COS, CSAVE, CURSOR, DATA, DEG, DEGREE, DIM, DMS, END, EQU #, EXP, FOR/TO/STEP, GOSUB, GOTO, GRAD, IF/THEN,

INKEY$, INPUT, INPUT #, INT, LEFT$, LEN, LET, LIST, LIST #, LLIST, LLIST $, LN, LOG, LPRINT, MEM, MEM #, MERGE, MID$, NEW, NEW #, NEXT, NOT, ON...GOSUB, ON...GOTO, OR, PASS, PAUSE, PI, PRINT, PRINT #, RADIAN, RANDOM, READ, REM, RESTORE, RETURN, RIGHT$, RND, RUN, SGN, SIN, SQR, STOP, STR$, TAN, TROFF, TRON, USING, VAL and WAIT.

Many of these will be familiar to even early PC-1211 users, but note that there are many new ones, such as those ending in $ (for string operations) and some of those ending in the # sign (such as EQU #) which are associated with the "Easy Simulation Programming" mode.

PC-1500 users as well as 1250 afficionados may also note that there are no PEEK or POKE directives. This may be a disappointment to those people who like to delve into machine language programming. It could be a real challenge - perhaps impossible - to "crack" into this PC and utilize it at the machine level. On the other hand, the lack of PEEK and POKE coupled with the fact that there is a PASS (password) statement, could be encouraging to software developers. The PASS command allows you to effectively protect a program so that it cannot be listed, modified or copied. In earlier models, such as the 1250, the PASS directive could be circumvented by an astute programmer using the PEEK and POKE directives. Since there are lots of astute programmers around these days (especially amongst readers of *PCN*), trying to protect a program using the PASS command has not been a very secure method in the past. The lack of PEEK and POKE in the 1261 may make the password option more effective as a security device.

PC-1500 programmers might note that statements associated with printing operations, such as LCURSOR, are absent. The 1261 appears to be more difficult to program for use with a printer such as the CE-125 or CE-126P. This appears to be due primarily to the fact that in normal use only two fields can be printed on a 24-character line. Alphanumeric (string) data is printed left-justified within a 12-character field. Numeric data is printed right-justified in a similar 12-character field. Two 12-character fields make up a 24-character printer line. This is somewhat restrictive. You might think this could be circumvented by the use of LPRINT USING statements. While the instruction manual suggests that numeric and alphanumeric data can be mixed within a printed line through LPRINT USING formats (such as ##.##&&&&&####&&&&&), tests indicate you can only switch from string data to numeric data (or vice-versa) once within a printed line! This makes it tough to print fancy stuff (do "pretty-printing").

[There is a way around this limitation. It requires that you convert numeric data into string format. You can then build up, say, a 24-character string-variable that combines several alphanumeric segments (including those segments that were converted from numeric format) under one variable name. This entire string can then be printed out by declaring a USING format that consists of, say, 24 alphanumeric characters.]

Considering that the PC-1261 was really designed to fit into a shirt pocket sans printer, it is not surprising that its printer-driving software is somewhat limited compared to, for instance, that of the PC-1500.

All-in-all, the PC-1261 seems to be a nice advance in the state-of-the-art. Having 10K of user memory available in a truly pocketable unit is nice. Being able to maintain your library of programs from the earlier PC-1211/PC-1250 models is definitely a plus factor. And, having advanced features such as 2-dimensional arrays and the "automatic calculation", (coupled with the extra memory) is a nice kicker. If you have been thinking about upgrading your pocket computing power, take a good look at the PC-1261. It may be just the solution to your advancing needs!

POCKET WORDPRO

This machine language program converts the Sharp PC-1500/PC-1500A or Radio Shack PC-2 into a simple word processor. Admittedly, it is stretching things a bit to call it a word processor. It will not relocate paragraphs, search for words, do automatic page numbering or print headers and footers. But, it is easy to learn to use and its capability may surprise you.

When the program is in use, all but about 500 bytes of RAM is used as a text storage area. Using a PC-1500A equipped with a CE-161 (16K) memory module, this means that you have over 22,000 bytes of character storage! You simply type in the text you want printed and then tell the computer to print it. Printing is done in vertical format, separated into pages of twelve 42-character lines each. The computer will determine where to end a line to avoid splitting a word and it will left-justify each printed line. You may indent paragraphs and center headings. However, centering of lines is not automatic.

Editing is simplified by the fact that you use the cursor controls the same way you are accustomed to using them -- with a few improvements! Insertion and deletion are auto-repeat. The computer will continue inserting or deleting as long as you keep the key held down.

Text may be saved, loaded or merged from cassettes, in the same simple way it is done for BASIC programs!

Loading the Program

You will need to load the ML codes in the listing, using either POKE statements or a Monitor program. It is 503 bytes long, but needs to be done only once. You can save the program on cassette. You must have either a CE-155, CE-159 or CE-161 memory module (8K or 16K expansion). Before testing the program, save it on tape using:

```
CSAVE M "POCKET WORDPRO";&3800,&39F6
```

Then, if you have made any errors in entering the program, at least you won't have to re-enter the whole listing.

After you have a correctly-entered program, you can relocate it by specifying a different CLOAD M address when loading. The best choice is made by loading with CLOAD M 256 * PEEK &7863. This will insure that you are using all the memory your computer has available. (This program will *not* work if loaded into the 7C00 - 7FFF area of the PC-1500A.)

Since PRO and REServe modes have no use with this program, the PC should be LOCKed in the RUN mode as a precaution against disaster.

Executing the Program

There are two addresses used in CALL statements. One is used when starting up the program and the other when continuing operations following a BREAK. The first of these is the beginning address at which the program is located. This would be &3800 when the program is located as shown in the accompanying listing. If you have relocated the program as suggested above, the address would be 256*PEEK &7863. When you begin execution with CALL &3800 (or CALL 256*PEEK &7863), you will clear the entire text area. Hence, you will want to be careful not to execute this call later on, unless you want to deliberately clear whatever text you have entered.

The second of the addresses to be used in a CALL is &381D (or &1D+256*PEEK &7863). To make things convenient, you can put this address into variable C. Then, if you need to continue the program after a BREAK (either intentional or unintentional), you can simply execute CALL C.

Entering and Editing Text

After you have started up the program will CALL &3800 (or, if relocated, CALL 256*PEEK &7863), you should see an underscore indicating the cursor position at the left end of the display. Start typing. If you want to indent your initial paragraph by 3 spaces, type 3 space before beginning your first sentence. All characters, including the quotation mark, are usable. If you want to enter any of the characters labeled above the REServe keys, you will need to SHIFT for them. Note that you may use the SML key in the usual way.

The cursor-left/right keys operate in the normal fashion, with auto repeat when held.

The up-arrow and down-arrow keys will change the displayed portion of text by 26 characters. They also automatically repeate when held down. If up-arrow is held, you can reach the beginning of text fairly quickly. Down-arrow may be used to locate the end of text. Note that the operation of these keys is somewhat similar to their operation when scanning back and forth through the lines of a BASIC program.

Insert and Delete operate about the same as they normally do. However, for multiple insertions or deletions, you do not have to repeat SHIFT with each use. Furthermore, the insertion and deletion continue rapidly when the corres- ponding key is held down. Thus you may delete sections of text rather quickly.

Keying ENTER will display a solid rectangle that is used to mark the end of a paragraph. This makes it easy to locate paragraph endings as you scan rapidly through the text using the up-arrow or down-arrow keys. Remember to type three spaces following the ENTER if you are indenting paragraphs. Note also that the ENTER key should be used immediately following the concluding punctuation mark of the last sentence in a paragraph.

To see how many bytes of unused memory are remaining, just hold down the RCL key. When you release this key, you will be back to where you were before.

To print the entered text, key DEF P. A blank line is printed between paragraphs, except at the top of a page.

Note that a sequence of more than 42 characters that are not separated by spaces will not fit on a 42-character line. In the unlikely event that such a sequence is encountered, the printer will stop. You will have to do appropriate editing to

Program *WordProcessor ("WORDPRO") for the PC-1500/PC-2.*

```
3800 FD 58 FD 40
3804 B5 F5 FD CA
3808 CA 65 CA 50
380C CC 64 4A 00
3810 46 CA 52 FD
3814 6A CC 65 BE
3818 DF E2 BE D3
381C C5 BE D0 2B
3820 B5 40 AE 78
3824 80 CC 50 CA
3828 50 FD 98 5A
382C B0 6A 19 F5
3830 88 03 FD 1A
3834 BE E8 CA BE
3838 E2 43 28 CC
383C 50 81 09 45
3840 99 03 46 46
3844 CA 67 CD 42
3848 EB 7B 0E 40
384C 6C 08 89 0C
3850 5E B0 56 99
3854 21 54 46 05
3858 99 33 3E 28
385C 6C 0C 89 0C
3860 15 9B 2F 54
3864 5E CA 91 41
3868 44 56 9E 45
386C 6C 0A 89 0D
3870 B5 1A FD CA
3874 47 9B 03 DD
3878 9B 06 44 8E
387C 0A 6C 0B 89
3880 14 B5 E6 FD
3884 CA FD 42 F4
3888 78 65 BE DF
388C E2 81 02 CC
3890 65 5A B0 9E
3894 6E 6C 1C 89
3898 04 B5 0C 8E
389C 06 6C 1D 89
38A0 48 B5 08 28
38A4 FD C8 FD 98
38A8 15 8B 28 14
38AC 5A B0 10 FD
38B0 CA 6C 08 8B
38B4 10 68 20 05
38B8 2A A4 41 24
38BC 28 99 08 CC
38C0 52 49 00 8E
38C4 07 FD 6A 44
38C8 45 61 99 04
38CC CC 50 6A 19
38D0 F5 88 03 FD
38D4 1A BE E8 CA
38D8 BE E2 43 EB
38DC 7B 0E 40 28
38E0 CC 50 FD 8A
38E4 A6 9B 43 9E
38E8 9D E9 7B 0E
38EC BF 6C 0D 89
38F0 02 68 7F 6C
38F4 80 83 19 6C
38F8 20 81 15 14
38FC B1 B0 FD CA
3900 84 A7 78 52
3904 81 04 4E FF
3908 93 D6 A4 0E
390C CC 50 9E AD
3910 6C 19 89 17
3914 45 39 03 F4
3918 78 52 64 BE
391C DF E2 CD 10
3920 00 BE EE EF
3924 BE E4 2C 99
3928 05 9E F7 6C
392C 90 99 FB A5
3930 B0 00 DD 9B
3934 0C FD 98 45
3938 99 03 DD AE
393C 77 4E AE 79
3940 F2 DD AE 79
3944 F4 46 46 CA
3948 67 CC 65 CA
394C 54 EB 79 F0
3950 FF BE AC 97
3954 B5 D8 FB B1
3958 12 FD C8 48
395C 7B 4A 7F 43
3960 B5 00 43 43
3964 0E BE AC 07
3968 BE A7 69 CC
396C 54 ED 77 4E
3970 F0 8B 0C E9
3974 77 4E 0F FD
3978 8A FD C8 B7
397C C6 89 52 ED
3980 77 4E 0F 8B
3984 09 E9 77 4E
3988 F0 05 8B 05
398C 8E 16 45 89
3990 0E FD 8A DD
3994 B7 C7 89 3D
3998 FD C8 BE A9
399C D5 8E 49 B7
39A0 20 9B 15 46
39A4 CA 56 6A 00
39A8 05 8B 1B 44
39AC B7 7F 89 05
39B0 AE 77 4E 8E
39B4 11 60 6E 2A
39B8 99 12 47 B7
39BC 20 8B 05 62
39C0 99 08 9E 33
39C4 44 44 FD A8
39C8 CA 54 FD 2A
39CC CC 56 BE B4
39D0 F4 FD 8A 99
39D4 7F FD C8 48
39D8 7B 4A 7F B5
39DC 00 43 43 B5
39E0 C0 43 B5 FD
39E4 0E BE AC 07
39E8 BE A7 69 FD
39EC 8A 9B 9E BE
39F0 AC BB FD 1A
39F4 9E CD 00
```

correct this condition before trying to print again.

The BREAK key (actually, the ON key) may be used to discontinue execution of the program. There are two reasons for wanting to do this: (1) you want to save or load text on cassette, or (2) you want to quit and use your computer for some other task. It is also possible to unintentionally press this key. To get back into the program, you can execute CALL C -- provided that you have previously stored &1D + the starting address into variable C, as suggested earlier. Your text will then reappear in the display, right where you left off.

If you should use BREAK to interrupt the printer while it is busy printing your text, you should execute TEXT to reset the printer.

The MODE, CL, OFF and Reserve-Group-Selector keys are inoperative while the program is running.

Using Cassette Tape

Following a BREAK, the CSAVE directive may be executed (in immediate mode) to record the text that is stored in memory. The recording may also be verified using CLOAD? (As usual, the use of a specific file name is optional.)

A previously-recorded file of text may be loaded into memory using CLOAD (again, in immediate mode) following a BREAK. Text already in memory (if any) may first be cleared by the initialization routine (executed by CALL starting address).

Executing MERGE will append recorded text to that currently in memory. (It does *not* prevent you from editing earlier portions, as is the case with BASIC programs.)

Centering

A heading may be centered by treating it as a paragraph and indenting an appropriate number of spaces. For example, to center a 12-character heading, note that (with a 42-character line) there will be 30 spaces left over. Therefore, indent 15 spaces, then type in the heading and follow it by ENTER. (It will look a little bit funny if this centered heading happens to be located at the bottom of a page -- you just have to take your chances!)

Note that these centered heading may occur only: (1) at the very beginning of text, or (2) immediately following the end of a paragraph that has been terminated using the ENTER key.

To Quit

When you are finished using the program and want to do something else with your computer, key BREAK and then execute NEW 0.

Summary of Operation

1. Load program with CLOAD M 256*PEEK &7863.
2. Execute C=&1D + 256 * PEEK &7863.
3. Initialize with CALL 256 * PEEK &7863.
4. Start typing. (Or, key BREAK and load in previously-recorded text file using CLOAD, then CALL C.)
5. Cursor controls operate with auto-repeat. Key ENTER to end a paragraph. Hold the RCL key to see how much memory is available.
6. To print, key DEF P.
7. To save on tape, key BREAK, execute CSAVE, return to program via CALL C.
8. To quit press BREAK then key NEW 0.

Do you know of any other word processor whose instructions are that simple? Perhaps we ought to try keeping things in perspective, however. This isn't really a *serious* word processor, let's admit it. (How *could* it be, when there isn't even an apostrophe?) In spite of that, many users may find it useful.

Thanks for this clever machine language program should be directed to: *Norlin Rober, 407 North 1st Avenue, Marshalltown, IA 50158*

PERSPECTIVE PLOT

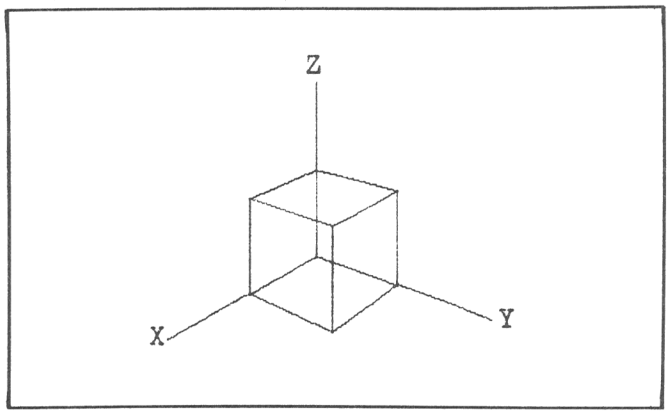
You can use this program on a Sharp PC-1500 or Radio Shack PC-2 to plot line segments and form a perspective drawing.

The line segments to be projected onto a plane of projection lie within a cube. The size of this cube is specified by the user in response to an INPUT prompt. The X, Y and Z coordinates of the end points of these segments must be specified (as positive numbers) in DATA statements starting at line 100. The letter S as a DATA item specifies the start of a new sequence of connected line segments. The final DATA item should be the letter E, which is interpreted as the end of the list. Here is an example illustrating the use of DATA statements to produce a cube:

```
100 DATA 0,0,1,1,0
    ,1,1,0,0,0,0,0
    ,0,0,1,0,1,1,1
    ,1,1,1,1,0
101 DATA 0,1,0,0,1
    ,1,S,1,1,1,1,0
    ,1,S,0,0,0,0,1
    ,0,S,1,1,0,1,0
    ,0,E
```

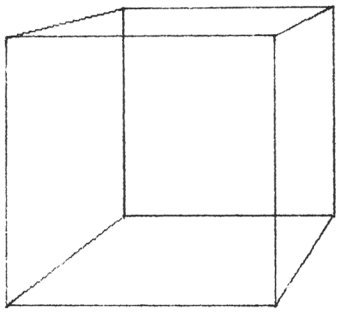
The relationship between the X, Y and Z coordinates is illustrated in the accompanying diagram.

Diagram *X, Y and Z Coordinates for Simple Cube.*

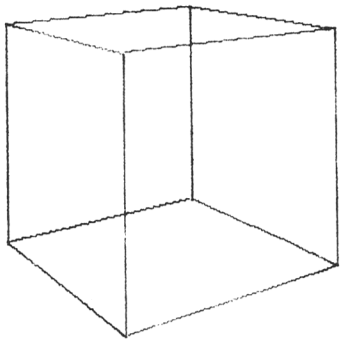


The point from which the cube (or object within a cube) is to be viewed is specified by the user in response to prompts. Its location, *relative to the center of the cube,* is L units in the X- direction, M in the Y-direction and N in the Z- direction. Note that L, M and N are measured in the same units as the X, Y and Z coordinates. The view point may be chosen in any direction from the center of the cube containing the object projected. However, it may

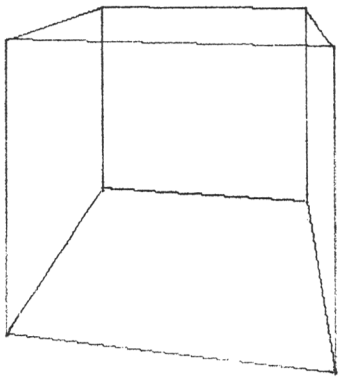
Diagram *Data and Several Sample Perspectives.*



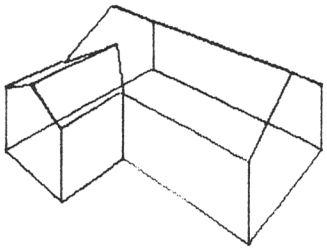
1-PT PERSP, FROM
4, 1.5, 1



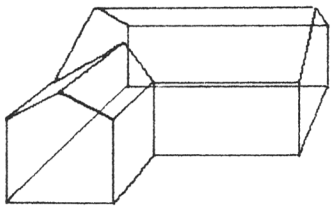
2-PT PERSP, FROM
3, -2, 1



2-PT PERSP, FROM
2, 0.3, 0.8



2-PT PERSP, FROM
75, 65, 50



1-PT PERSP, FROM
150, 60, 55

Diagram *Several Perspectives of a Cube.*

```
100:DATA 5,50,0,5,
    50,15,20,50,25
    ,35,50,15,35,5
    0,0,5,50,0
101:DATA 5,35,50,0
    ,35,20,0,50,20
    ,0,50,0,0,50,0
    ,15,50,10,20,5
    0,20,15
102:DATA 35,20,15,
    35,50,15,5,35,
    20,0,35,20,15,
    27.5,10,20,35,
    0,15,20,0,25,2
    0,50,25
103:DATA 5,50,0,0,
    5,0,0,5,50,0,5
    ,5,0,0,5,0,15,
    5,5,50,15,5,0,
    15,20,0,25
104:DATA 5,50,0,15
    ,35,0,15,5,27.
    5,10,20,50,10,
    20,50,20,15,50
    ,20,0,E
```

Program *Perspective Plot.*

```
10:INPUT "VIEW PO
   INT: L? ";L,"M
   ? ";M,"N? ";N
11:INPUT "1 OR 2-
   POINT? ";T
12:INPUT "CUBE SI
   ZE? ";D:D=D/2
13:CLS :IF T=2
   THEN 30
20:IF ABS L<=D
   THEN 60
21:A=1/(1-D/ABS L
   ),B=1/(1+D/ABS
   L),C=1/(ABS L+
   ABS M)
22:K=108*C/D,HX=K
   *M,HY=K*L
23:VX=K*N*SGN L,V
   Y=0,VZ=K*ABS L
24:P=A*B:IF ABS M
   <DLET P=A*C*
   ABS L
25:PX=P/L,PY=0,PK
   =P+P*D/L
26:H0=108*A/P:IF
   L*M<0LET H0=21
   6-H0
27:K=-108*C/P:IF
   N>DLET V0=K*B*
   (ABS L+N),VB=2
   *V0*A:GOTO 40
28:V0=K*A*(ABS L-
   N):IF N>-DLET
   VB=2*K*A*ABS L
   :GOTO 40
29:VB=2*V0*B:GOTO
   40
30:IF ABS L<=DAND
   ABS M<=DTHEN 6
   0
31:A=D*(ABS L+ABS
   M),B=D*ABS (
   ABS L-ABS M),C
   =L*L+M*M
32:K=108/A,HX=K*M
   ,HY=K*L
33:K=K/J(C+N*N),V
   X=K*N*L,VY=K*N
   *M,VZ=K*C
34:IF ABS L<DOR
   ABS M<DLET P=(
   B/A/(C-A)+1/(C
   -B))/2:GOTO 36
35:P=(1/(C+B)+1/(
   C-B))/2
36:PX=P*L,PY=P*M,
   PK=P*(C+(L+M)*
   D)
37:H0=108/P/(C-B)
   :IF M*SGN L>L*
   SGN MLET H0=21
   6-H0
38:S=A*SGN (N-D):
   V0=-K/P*(C*D+N
   *S)/(C+S):IF
   ABS N>DLET VB=
   2*C*V0/(C-S):
   GOTO 40
39:VB=2*C*V0/(C-A
   *N/D)
40:HK=(HX-HY)*D,V
   K=(VX+VY-VZ)*D
   ,V0=V0-20,S=1E
   99,E=2E99,F=0:
   RESTORE 100:
   GRAPH :SORGN
41:READ X:IF X>=S
   THEN 45
42:READ Y,Z:P=PK-
   PX*X-PY*Y,H=H0
   +(HK-HX*X+HY*Y
   )/P,V=V0+(VK-V
   X*X-VY*Y+VZ*Z)
   /P
43:IF FLINE -(H,V
   ):GOTO 41
44:GLCURSOR (H,V)
   :F=1:GOTO 41
45:F=0:IF X=STHEN
   41
50:GLCURSOR (0,VB
   -60):TEXT :
   PRINT "KEY ENT
   ER TO PRINT"
51:LPRINT T;"-PT
   PERSP, FROM":
   LPRINT L;",";M
   ;",";N:END
60:PRINT "NO PLOT
    POSSIBLE":END

 STATUS 1     1131
```

not be located *within* the cube. If the view point is chosen close to the cube, the resulting drawing will appear distorted. This is particularly true when N is large compared to L and M. In extreme cases the vertical range of the printer/plotter may be exceeded. For 1-point perspectives, the most pleasing views are obtained when L is at least twice as large as either M or N.

The plotted result will be scaled by the program to automatically produce a projection that spreads the cube over the full width of the plotting area.

The accompanying diagram shows examples of perspective views of a cube, plotted using the DATA statements listed earlier. The user should input 1 in response to the CUBE SIZE? prompt. Another figure illustrates a second example. In it, 50 should be input for the cube size. (For a rear view of the house, try -75, 65, 50 as L, M and N in a 2-point perspective. For an end view, try 0, 1000, 0.)

In a 1-point perspective projection, the plane of projection is parallel to one vertical face of the cube. In a 2-point perspective, the plane is perpendicular to a horizontal line connecting the center of the cube with the vertical line through the view point. In either case, the resulting projection is what a photograph would show, provided that the camera's film plane is parallel to the plane of projection.

Although entering DATA statements specifying coordinates can be a tedious process, once it has been done a wide variety of views of the object may be drawn. After you have determined the best view point, you wish to delete the DATA statements that involve hidden lines.

This program provided by: *Norlin Rober, 407 North 1st Avenue, Marshalltown, IA 50158.*

ALTERNATE CHARACTER SETS

This program, written entirely in machine language, provides for a convenient way of creating characters for display.

When you use this program there is no need to calculate binary codes. You simply use cursor controls and the decimal-point key to create the desired character in the display. Once characters have been defined they may be assigned to shifted keys for later recall.

Generation of Alternate ASCII Codes

In normal use, the keyboard input routine in ROM obtains an ASCII code from tables in ROM. The table for unshifted keys is located in addresses FE80 - FEBF. Shifted keys occupy FEC0 - FEFF.

When bit 2 of address 764E is set (as indicated by the Japanese Katakana annunciator), codes are obtained from alternate Key-to-ASCII tables. These tables are located at nn80 - nnBF and nnC0 through nnFF, where nn is one less than the byte stored in RAM address 785E. Keying SML twice will cancel the alternate keycode mode.

Alternate Display Characters

A ROM table containing codes for generating the display characters assigned to ASCII codes is located in FCA0 - FE7F. Each character is specified using 5 bytes. Normally, codes 80 - FF produce (by default) the same characters as the ASCII codes do. However, if RAM location 785D contains hexadecimal 80, an alternate table is used to obtain display codes for characters represented by codes greater than &80. Since codes above &80 are not ASCII codes, this table forms an extension of, rather than a replacement for, the set of available characters.

This alternate table begins at address nn00, where nn is the byte contained in address 785E.

Whenever the computer is powered up following a power down using the OFF key, the contents of 785D will be set to FF, thereby causing the alternate display mode to be cancelled.

An Alternate Character Set Program

Execution of CALL &7C72, when this program is in memory in a PC-1500A, will set both the alternate key code and alternate display modes.

Shifted alphabet and numeral keys will generate the codes A1 to C4 (rather than the usual ASCII codes for lower-case characters). These codes are displayed as characters that have been defined by the user. The ASC and CHR$ functions also apply to these codes.

After the alternate key code and alternate display modes have been set by CALL &7C72, execution of CALL &7D00 initiates a routine for formation of user-defined characters. The display will blank. Depress the key (alphabet or numeral) to which a character is to be defined. The symbol for that character will appear, followed by a 5 by 7 grid. The position of a "dot cursor" within this grid is indicated by an unlit dot.

The right and left cursor keys may be used to move the "dot cursor" through this grid. Keying the decimal-point key will enter a dot in the position indicated by the dot cursor, into the character being formed. Keying SPACE will clear a dot. The character being formed will be displayed in the position to the right of the dot cursor grid.

When the desired character has been completed, key ENTER to store it into memory. It will be displayed whenever the assigned key (following SHIFT) is depressed.

If BREAK is used to exit the character-creation mode, the character will not be assigned.

Using the Program with the PC-1500

The preceding instructions and listing of the machine language program apply to the Sharp PC-1500A. Since the earlier Sharp PC-1500 and the Radio Shack PC-2 do not contain RAM in the address range 7C00 - 7FFF, a different location is required. The program itself is relocatable without modification. However, its possible locations are restricted by the necessity to locate the Key-to-ASCII table and the Character Table at locations compatible with the PC's operating system routines.

The following locations are suggested for various memory configurations:

1. PC-1500 with CE-155 memory module. First assign the BASIC area with NEW &3B59. Enter the machine language program beginning at &3972, with it ending at &3AA3. (The character table will use the area &3AA5 - 3B58.) To execute the mode-setting routine, use CALL &3972. For the character-setting routine: CALL &3A00.

2. PC-1500 with CE-159 memory module. Begin with NEW &2359. Load the machine language program in the area &2172 - 22A3. The character table will occupy &22A5 - 2358. To execute the mode-setting routine use CALL &2172. For character creation, use CALL &2200.

3. PC-1500 with CE-161 memory module. Begin with NEW &0359. Load the machine language

program into the &0172 -02A3. The character table will occupy &02A5 - 0358. Set the mode using CALL &0172. For character creation use CALL &0200.

4. PC-1500 unexpanded. Use NEW &4359. Load the machine language program into &4172 - 42A3. The character table will occupy &42A5 - 4358. Set the mode using CALL &4172. For the character-setting routine: CALL &4200.

Location of Stored Character Codes

In the PC-1500A version, the codes that produce the characters defined by the user are stored in the area &7DA5 - 7E58. They may be viewed by using PEEK. These are the codes that can be used with

Table *Character Codes.*

ADDR	KEY	ASCII
7DA5	A	A1
7DAA	B	A2
7DAF	C	A3
7DB4	D	A4
7DB9	E	A5
7DBE	F	A6
7DC3	G	A7
7DC8	H	A8
7DCD	I	A9
7DD2	J	AA
7DD7	K	AB
7DDC	L	AC
7DE1	M	AD
7DE6	N	AE
7DEB	O	AF
7DF0	P	B0
7DF5	Q	B1
7DFA	R	B2
7DFF	S	B3
7E04	T	B4
7E09	U	B5
7E0E	V	B6
7E13	W	B7
7E18	X	B8
7E1D	Y	B9
7E22	Z	BA
7E27	0	BB
7E2C	1	BC
7E31	2	BD
7E36	3	BE
7E3B	4	BF
7E40	5	C0
7E45	6	C1
7E4A	7	C2
7E4F	8	C3
7E54	9	C4

Program *Alternate Character Sets.*

```
7C72 FD 58 84 DD   7D0E FD C8 BE ED
7C76 0A 48 80 CA   7D12 57 EC 41 41
7C7A 5D EB 76 4E   7D16 41 4A 04 DF
7C7E 04 9A 0B 4E   7D1A 43 43 43 43
7C82 59 01 48 38   7D1E DF 0E B5 0A
7C86 35 32 09 58   7D22 AE 78 75 2A
7C8A 57 11 53 0F   7D26 58 7A 5A 00
7C8E 2D 2E 30 4D   7D2A 55 BE ED EF
7C92 55 15 4A 37   7D2E CD 8E 88 08
7C96 34 31 0D 28   7D32 BE E2 43 C3
7C9A 49 16 4B 4F   7D36 42 CD 54 4A
7C9E 4C 29 19 43   7D3A 00 5A 06 6A
7CA2 45 12 44 2F   7D3E 04 B7 2E 8B
7CA6 2A 2B 20 56   7D42 25 B7 20 8B
7CAA 52 13 46 50   7D46 2A B7 0D 8B
7CAE 08 3D 02 5A   7D4A 42 B7 0C 8B
7CB2 51 1B 41 18   7D4E 29 B7 08 99
7CB6 1F 0C 0A 42   7D52 21 45 B7 FF
7CBA 54 14 47 39   7D56 9B 05 46 4B
7CBE 36 33 5B AE   7D5A FF 42 93 3F
7CC2 B9 01 A8 C3   7D5E 4A 04 FB D1
7CC6 C0 BD 09 B8   7D62 93 45 B5 BF
7CCA B7 21 B3 0F   7D66 9E 49 45 BD
7CCE 2C 2E BB AD   7D6A FF 1B 51 88
7CD2 B5 25 AA C2   7D6E 07 8E 05 45
7CD6 BF BC 0D 3C   7D72 19 51 88 05
7CDA A9 26 AB AF   7D76 4A 00 45 B7
7CDE AC 3E 19 A3   7D7A FF 9B 05 46
7CE2 A5 22 A4 3F   7D7E 4B FF 44 4E
7CE6 3A 3B 5E B6   7D82 05 91 66 4A
7CEA B2 23 A6 B0   7D86 00 DB 9D 6B
7CEE 1D 40 02 BA   7D8A D9 9E 6E FD
7CF2 B1 1B A1 1A   7D8E 8A B1 41 83
7CF6 1E 1C 5D A2   7D92 02 B3 2B FD
7CFA B4 24 A7 C4   7D96 58 4A A5 FD
7CFE C1 BE BE EC   7D9A CA D9 D9 FD
7D02 A2 BE E4 2C   7D9E CA 55 41 88
7D06 B7 30 91 07   7DA2 04 9A
7D0A B7 3D 9B 0B
```

GPRINT statements to produce the same characters.

The accompanying table provides the following information: 1) the address of the first of the five bytes that are used to generate the character, 2) the key to which that character is assigned, and 3) the code for the character, acting like an ASCII code.

SAVEing the Program on Tape

The program may be saved on tape using the CSAVE M statement. For the PC-1500A execute: CSAVE M "ALT CHAR SET";&7C72,&7DA3. (If you want to save the characters you have created,

along with the program, then use the command: CSAVE M "ALT CHAR SET";&7C72,&7E58.)

If you are using the PC-1500 or PC-2, the addresses in the CSAVE M statement will need to be modified to coincide with the area of memory used. For example, when using the CE-155 memory module, save the programing using: CSAVE M "ALT CHAR SET";&3972,&3B58.

To reload the program, simply execute: CLOAD M.

A Suggestion

You can save a lot of typing by assigning the two CALL statements to a couple of REServe keys.

Norlin Rober, 407 North 1st Avenue, Marshalltown, IA 50158, provided this program.

INSIDE THE PC-1500

This is the fifth part of the current series on the Sharp PC-1500. (Most of this information is also applicable to the Radio Shack PC-2.) This valuable information is supplied through the efforts of *Norlin Rober, 407 North 1st Avenue, Marshalltown, IA 50158.* This issue continues from Issue 34 of *PCN.* Norlin has been describing a number of the ROM routines. Many of the functions they perform are of value to machine language programmers when called as machine language subroutines. Norlin has spent a great deal of effort deriving this information and taking the time to write about it. If you use it, try and find time to let him know how much you appreciate it!

TERMINATE WITH ERROR MESSAGE

The following routines will terminate a machine-language program with an ERROR message displayed in 'Ready' mode:

(a) Call E0 (CD88) displays ERROR n, where n is contained in UH

(b) Call E4 (CD89) displays ERROR 1

When the ERROR message is displayed, the up arrow key may be used to display a BASIC line at the address pointed to by Y. A meaningless display will result unless an effort has been made to load Y to point to the desired location.

Register Y can be made to point to the location in BASIC from which the machine-language program was called by either of the following:

(a) Provided that the stack has been kept balanced, POP Y twice.

(b) Load register S with 784A; then execute POP Y.

PRINTER ROUTINES

MOTOR OFF

Subroutine A769 is required following certain Printer subroutines.

EQUIVALENTS OF CERTAIN BASIC STATEMENTS

TEXT	Subroutines ACBB, A9D5, A769
GRAPH	Subroutines A9D5, A769, ABEF; store FF into 79F0
CSIZE n	Store n (1 to 9) into 79F4
COLOR n	Subroutine A519. Precede by loading UL with n (0 to 3). Follow by subroutine A769 (Motor off)
LF n	Subroutine AA04. Precede by storing n (in signed binary) into 7B7F-7B80, and loading XH with 7B, XL with 7F.

(b) Load XH with 7B, XL with 7C
(c) Execute subroutine AD78. Follow by subroutine A769 (Motor off)

(2) To move Pen to location having coordinates (x,y):

(a) Specifying x and y in two-byte signed binary, store x into 7B7E-7B7F, and y into 7B7C-7B7D
(b) Load XH with 7B, XL with 7C
(c) Execute subroutine AC07. Follow by subroutine A769 (Motor off)

(3) To draw a line, starting from current Pen location, using given increments in x and y:

(a) Specifying increments in two-byte signed binary, store the x-increment into 7B7E-7B7F, and the y-increment into 7B7C-7B7D
(b) Load XH with 7B, XL with 7C. Store FF into 79E9: store line type (0 to 9) into 79EA; store 01 into 7B84
(c) Execute subroutine AD07 (Draw line) and A769 (Motor off)

(4) To draw a square, taking current Pen location as lower left corner:

(a) Load A with length of a side of the square
(b) Load XH with 7B, XL with 7F. Store line type (0-9) into 79EA
(c) Execute subroutine AC2F (Draw square) and A769 (Motor off)

(5) To draw a rectangle, beginning at current Pen location:

(a) Specifying dimensions in two-byte signed binary, store the x-dimension into 7B7E-7B7F, and the y-dimension into 7B7C-7B7D
(b) Load XH with 7B, XL with 7C; store FF into 79E9; store line type (0 to 9) into 79EA
(c) Execute subroutine AD64 (Draw rectangle) and A769 (Motor off)

PRINTING IN GRAPH MODE

(1) To Print contents of R0 (or string Pointed to by R0), formatted, starting from Present Pen location, in direction specified by ROTATE:

(a) Store format specifications into 7BAA-AD, as in TEXT mode
(b) Store zero into 79EA and 79F5
(c) Execute subroutine B433. Follow by subroutine A769 (Motor off)

(2) To Print a single character, in direction specified by ROTATE:

(a) Store the ASCII code of the character to be Printed into 7B7F
(b) Load XH with 7B, XL with 7F. Store zero into 79EA
(c) Execute subroutine A781. Follow by subroutine A769 (Motor off)

PRINTING PROGRAM LINES (TEXT MODE)

(1) To Place a Program line into the InPut Buffer Prior to Printing:

The line to be Printed must be Put into the InPut Buffer, starting with its two-byte line number, omitting the link byte, and continuing with the codes for the BASIC statements in the line. A line may be

```
            Follow by subroutine A769 (Motor off)
LCURSOR n   Subroutine AC52.  Precede by loading XH with FF, and
            XL with n.  Follow by subroutine A769 (Motor off)
SORGN       Subroutine AC97
ROTATE n    Store n (0 to 3) into 79F2
```

PRINTING IN TEXT MODE

(1) To print contents of R0 (or string pointed to by R0), using default format:

Store 04 into 788E; execute subroutine B3EA.

Numeric data is printed right-justified; strings, left-justified. Printer advances to next line if necessary. If CSIZE set is larger than 2, it will be changed to 2. TEXT mode will be set. A carriage return (with line feed) will follow printing.

(2) To print contents of R0 (or string pointed to), formatted:

(a) Store format specifications into memory, as follows:
- 7BAA: Editing characters. 10, comma separation; 20, forced sign; 40, asterisk fill; 80, scientific format
- 7BAB: Number of characters preceding decimal point, including spaces for sign and commas (when specified)
- 7BAC: Maximum number of characters to be printed (in printing of character strings); if no limitation, zero
- 7BAD: Number of characters including and following decimal point

(b) Store zero into 79EA and 79F5
(c) Execute subroutine B49A (Print); optionally, subroutine A9F1 (CR with line feed); subroutine A769 (Motor off)

(3) To print contents of R0 (or string pointed to by R0), formatted, starting at current pen location, with line advance when necessary:

(a) Store format specifications into 7BAA-AD, as described above
(b) Store 00 into 79EA, 08 into 79F5
(c) Execute subroutine B49A. Follow by subroutine A769 (Motor off)

(4) To print a single character (no carriage return or line feed):

(a) Store the ASCII code of the character to be printed into 7B7F
(b) Load XH with 7B, XL with 7F. Store zero into 79EA
(c) Execute subroutine A781. Follow by subroutine A769 (Motor off)

(5) To execute carriage return with line feed:

Load XH with 7B, XL with 7F. Execute subroutines A9F1, A769

PLOTTING (GRAPH MODE)

(1) To move pen, using given x and y increments:

(a) Specifying increments in two-byte signed binary, store the x-increment into 7B7E-7B7F, and the y-increment into 7B7C-7B7D

Put into the InPut Buffer in that form in any of the followinG ways:

(a) Subroutine D25F may be used to Place the first BASIC line into the InPut Buffer; the SEARCH Pointer is set to Point to that line.

FROM THE WATCH POCKET

In a recent column in the magazine InfoWorld, John Gantz lamented the demise of the pocket and notebook computer field. Much of his pessimism apparently evolved from a personal experience wherein he tried to dispose of some 200 Texas Instrument Compact 40 handheld computers. We don't blame him for possibly being a little disappointed with the CC-40, but we do not think that the pocket and portable computer field is about to fade away.

Indeed, the signs are evident that all is well in the PC business despite recent withdrawals from the market by some suppliers. It does seem to currently appear that we are in a consolidation phase. Suppliers who can't match consumer's tastes are dropping out. Products are improving. New genre are being identified. The recently announced Sharp PC-1260 and 1261 models are good examples of this forward progress. The 1261, with its 10K of user RAM and 40K of built-in ROM software, points to the future. Here is a pocket computer that fits easily in a shirt pocket, yet contains enough power to really ease one's daily task. 10K of user memory is more than enough to hold several practical programs for use on a daily basis. The automatic calculation capability of the 1260 and 1261 are examples of the types of features that will be provided as standard in pocket computers of the future.

Pocket computers, now entering their fifth year of existence, are still in the pioneer stages. Manufacturers are beginning to learn just what it is that users want from their PC's. Models recently or about to be announced will provide more and more of what users seek. For example, the recently announced Casio FX-750P model and the upcoming Sharp PC-1350 allow for wafer-thin memory modules, complete with battery backup, to be easily plugged into the pocket computer. These new modules will make it easier for users to access a large variety of programs. They represent a significant step in the development of the PC towards becoming a practical tool for users from all walks of life.

Opportunities abound for visionaries and entrepreneurs who understand the vistas that are opening. While the society as a whole is still struggling with the legal concepts that need to be in place to protect both the consumer and producer in areas such as software copyright and protection, new technologies will make it practical to distribute information processing tools. For instance, the Sharp PC-1260 or 1261 can be password protected. This means that those with specialized knowledge or techniques can program this information into PC's and sell the entire package as a ready-to-use application tool. This can be accomplished with relatively low risk of having the source code and methodology comprised unless authorized by the program author. In the case of newer models, such as the PC-1350, application programs can be distributed installed directly in the battery backed RAM modules. Once again, various levels of source code protection can be provided at the author's discretion.

It should be noted that each generation of pocket computer products provides benefits in several areas. Not only is the hardware itself more powerful, but deficiencies in operating modes and capabilities are being corrected as a result of feedback from earlier users. And these early users have been speaking out. Hence, multiple line displays, which provide for the easier comprehension of data, will become the norm. Feedback from users indicates they would rather have several lines of information, even though the characters may be smaller, than having a single line that forces prompts to be remembered while data is being entered or leaves the user guessing about the interpretation of an output value.

In case you haven't heard, Sharp now produces a low cost combination thermal printer and cassette interface called the Model CE-126P. The list price of this unit is $94.95. The machine contains a 24 digit thermal printer as well as a standard audio-cassette interface. Originally designed for the EL-5500 and EL-5510 calculator units, this

machine will also work with the Sharp PC-1250/51 and PC-1260/61 models. Note that this unit is designed to operate with your own audio cassette unit and does not contain a micro-cassette recorder as does the more expensive CE-125. If you already have your own tape unit, the CE-126P appears to be good buy.

The new Sharp PC-1350 is due out in the middle of October. It is said to sport a four-line display, contain approximately five kilobytes of memory, and will retail for $195. This is the unit mentioned earlier in which you can install 8 or 16 kilobyte battery-backed RAM modules. It is reported to be approximately the size of an EL-5500. It looks for sure as though Sharp intends to remain a serious competitor in the pocket computer field.

As most of you know, Radio-Shack recently discontinued its PC-2 model. There has been no indication whether or not the giant chain intends to continue to support the pocket computer market. There closeout price on the PC-2 was $99.95. At about $80 cheaper than the Sharp PC-1500A, most stores quickly sold out. That was a good deal for those who were able to get in on it.

Radio-Shack apparently intends to remain active in the notebook computer field. In particular, it has recently announced a new software package for the Model 100 computer. Called Business Finance, the package is said to be a tool for both business and personal financial analysis. The package is reported to consist of 12 programs, including those used to calculate net present value, internal rate of return, financial management rate of return, and depreciation. The package also contains programs that assist one in making rent or buy decisions, perform lease/purchase analysis, machinery replacement analysis and bond analysis. Several other programs enable one to perform annuity computations, as well as calculate compound interest, leases, loans, and perform pension and portfolio analysis. The list price of the Business Finance Program is $39.95. It runs on a Model 100, equipped with at least 16 kilobytes of user memory.

A few months ago *PCN* ran a brief blurb about an outfit producing an A/D board for the PC-1500. The company, ENERTECH, *558 Highland Avenue, Upper Montclair, NJ 07043,* has announced that their new A/D 1500 I/O Interface is now in stock and available for immediate delivery. The price is $299.00 plus shipping charges. The interface allows one to use programs in either BASIC or machine language to allow collection of data in the form of a bit count between 0-255 (to represent analog information) or 0-1 to represent digital information. Information collected from the interface can be displayed, printed, or saved to a cassette tape. The interface can also be used to control relays, solenoids, light-emitting diodes, etc., at currents of up to 100 milliamperes (and potentials of as much as 12 volts). The A/D interface is powered by a small 12 volt battery. This battery can also supply a CE-150 printer/cassette interface. Write directly to the company or phone (201) 744-4962 for additional information.

If you have a Casio Model PB-700, you may be interested in checking out a new software package released by KASTER Corporation, *P.O. Box 117, Alpine, NJ 07620,* telephone (201) 784-9430. The package is called DeskMate. It is said to combine a database manager, spreadsheet, and graphics package into one integrated program. Up to 70 personal records or a 200 cell spreadsheet can be retained in memory. The graphics program can plot four different graphs from data generated by the spreadsheet. KASTER Corporation also states that it has other packages for the PB-700 available.

Hewlett-Packard Corporation has announced the availability of dBASE-II for The Portable (HP-110) computer. This is a powerful information management software package that has been available for several years on desktop computers. The package is supplied on diskette. It retails for $500. Contact your nearest Hewlett-Packard sales representative for additional information. Incidentally, the HP-110 continues to be a hot seller for Hewlett-Packard Corporation.

If you are into using personal computers at work, then you may be interested in a bi-monthly newletter that has just been announced. The newsletter claims to review a major best-selling software package from a general business category in each issue. The objective of the newsletter is said to be helping users to understand how to select from an incredible array of constantly updated software. Each report includes a summary, illustrations, real-world usage examples, and a "clip-and-save" tear sheet index of commands, as well as the reviewer's personal evaluation of the program's capabilities. For subscription information, contact Delicious Publishing, 314 East Holly #106, Bellingham, WA 98225.

POCKET COMPUTER NEWSLETTER

P.O. Box 232, Seymour, CT 06483